

IN THE CLAIMS:

Please amend Claims 1, 11, 13, 20, 26, 31, 32, 33, 44, 51, 52, 65, 73, 74, 78, 79, 80, 82, 96, 97, 108, 110, 113, 114, 115 and 116 as follows.

1. (Currently Amended) A method of creating an image, the image being formed by rendering a plurality of graphical objects to be composited according to an expression tree representing a compositing expression for the image, the expression tree including a plurality of nodes each representing at least one region of an object of the image or an operation for combining sub-expressions of the compositing expression, said method comprising the steps of:

determining an opacity region representation for ~~at least one~~ each node of the expression tree, the opacity region representation comprising one or more of three predetermined values, each predetermined value distinctly identifying whether a corresponding region of an object represented by the ~~at least one~~ node is an opaque region, a transparent region or a partially transparent region such that the opacity region representation simultaneously represents each opaque region, transparent region and partially transparent region of the object represented by the ~~at least one~~ node, wherein a union of each opacity region representation for the expression tree includes at least one of each of the three predetermined values;

determining an obscurance region representation for ~~the~~ at least one node based on an analysis of the opacity region representation associated with the at least one node ~~of the expression tree~~, such that, for said image, the at least one node simultaneously comprises both the opacity region representation and the obscurance region representation, with the obscurance region representation being separate from the opacity region representation of the at least one node and, the obscurance region representation being assigned one or more of a

plurality of further predetermined values, each further predetermined value of the obscurance region representation distinctly identifying whether a corresponding region of the object represented by the at least one node is visible in the image;

partitioning the object into a plurality of regions;

overlaying the obscurance region representation on the partitioned object such that the partitioned object is substantially encompassed within the obscurance region representation;

traversing the overlaid obscurance region representation to identify any of the plurality of regions of the partitioned object which include at least a portion of the visible region; and

creating the image by rendering the identified regions.

2. (Previously Presented) The method according to claim 1, said method including the further step of traversing the expression tree to detect the node including the obscurance region representation.

3. (Previously Presented) The method according to claim 1, wherein the obscurance region representation is traversed for each of the plurality of regions of the partitioned object.

4. (Previously Presented) The method according to claim 1, said method including the further step of producing a map for the plurality of regions, wherein the map at least indicates any region which includes at least a portion of the visible region.

5. (Previously Presented) The method according to claim 4, wherein the map includes a flag for each of the regions which includes at least a portion of the visible region.

6. (Previously Presented) The method according to claim 4, wherein the map is produced using run-length encoding.

7. (Previously Presented) The method according to claim 4, wherein the map is traversed in a predetermined order to determine the identified regions.

8. (Previously Presented) The method according to claim 1, said method including the further step of converting the expression tree into a right leaning expression tree.

9. (Previously Presented) The method according to claim 1, wherein the expression tree is a graphic object tree.

10. (Previously Presented) The method according to claim 1, wherein the obscuration region representation is a quadtree.

11. (Currently amended) A method of creating an image, the image being formed by rendering a plurality of graphical objects to be composited according to an expression tree representing a compositing expression for the image, the expression tree including a plurality of nodes each representing an object of the image or an operation for combining sub-expressions of the compositing expression, said method comprising the steps of:

determining an opacity region representation for ~~at least one~~ each node of the expression tree, the opacity region representation comprising one or more of three predetermined values, each predetermined value distinctly identifying whether a corresponding region of an object represented by the ~~at least one~~ node is an opaque region, a transparent region or a partially transparent region such that the opacity region representation simultaneously represents each opaque region, transparent region and partially transparent region of the object represented by ~~at least one~~ the node;

determining an obscurance region representation for ~~the~~ at least one node of the expression tree based on an analysis of the opacity region representation associated with the at least one node ~~of the hierarchical structure expression tree~~, such that, for said image, the at least one node simultaneously comprises both the opacity region representation and the obscurance region representation, with the obscurance region representation being separate from the opacity region representation of the at least one node ~~and~~, the obscurance region representation being assigned one or more of a plurality of further predetermined values, each further predetermined value of the obscurance region representation distinctly identifying whether a corresponding region of at least one object is visible in the image;

traversing the expression tree to detect the node including the obscurance region representation;

partitioning at least one object into a plurality of regions;

overlaying the obscurance region representation on the partitioned object such that the partitioned object is substantially encompassed within the obscurance region representation;

traversing the overlaid obscurance region representation to identify any of the plurality of regions of the partitioned object which include at least a portion of the visible region; and

creating the image by rendering the identified regions.

12. (Previously Presented) The method according to claim 11, wherein the obscurance region representation is traversed for each of the plurality of regions of the partitioned object.

13. (Currently Amended) The method according to claim 11, said method including the further step of producing a map for the plurality of regions, wherein the map at least indicates any region which includes at least a portion of the visible ~~the~~ region.

14. (Previously Presented) The method according to claim 13, wherein the map includes a flag for each of the regions which includes at least a portion of the visible region.

15. (Previously Presented) The method according to claim 13, wherein the map is produced using run-length encoding.

16. (Previously Presented) The method according to claim 13, wherein the map is traversed in a predetermined order to determine the identified regions.

17. (Previously Presented) The method according to claim 11, said method including the further step of converting the expression tree into a right leaning expression tree.

18. (Previously Presented) The method according to claim 11, wherein the expression tree is a graphic object tree.

19. (Previously Presented) The method according to claim 11, wherein the obscurance region representation is a quadtree.

20. (Currently Amended) An apparatus for creating an image, the image being formed by rendering a plurality of graphical objects to be composited according to an expression tree representing a compositing expression for the image, the expression tree including a plurality of nodes each representing an object of the image or an operation for combining sub-expressions of the compositing expression, said apparatus comprising:

opacity region representation determining means for determining an opacity region representation for ~~at least one~~ each node of the expression tree, the opacity region representation comprising one or more of three predetermined values, each predetermined value distinctly identifying whether a corresponding region of an object represented by the ~~at least one~~ node is an opaque region, a transparent region or a partially transparent region such that the opacity region representation simultaneously represents each opaque region, transparent region and partially transparent region of the object represented by the ~~at least one~~ node, wherein a union of each opacity region representation for the expression tree includes at least one of each of the three predetermined values;

obscurance region representation determining means for determining an obscurance region representation for ~~the~~ at least one node of the expression tree based on an analysis of the opacity region representation associated with the at least one node ~~of the expression tree~~, such that, for said image, the at least one node simultaneously comprises both the opacity region representation and the obscurance region representation, with the obscurance region representation being separate from the opacity region representation of the at least one node and, the obscurance region representation being assigned one or more of a plurality of further predetermined values, each further predetermined value of the obscurance region representation distinctly identifying whether a corresponding region of the object represented by the at least one node is visible in the image;

partitioning means for partitioning the object into a plurality of regions;

overlaying means for overlaying the obscurance region representation on the partitioned object such that the partitioned object is substantially encompassed within the obscurance region representation;

traversing means for traversing the overlaid obscurance region representation to identify any of the plurality of regions of the partitioned object which include at least a portion of the visible region; and

image creating means for creating the image by rendering the identified regions.

21. (Previously Presented) The apparatus according to claim 20, wherein said traversing means further traverses the expression tree to detect the node including the obscurance region representation.

22. (Previously Presented) The apparatus according to claim 20, wherein the obscurance region representation is traversed for each of the plurality of regions of the partitioned object.

23. (Previously Presented) The apparatus according to claim 20, further comprising map producing means for producing a map for the plurality of regions, wherein the map at least indicates any region which includes at least a portion of the visible region.

24. (Previously Presented) The apparatus according to claim 20, wherein the expression tree is a graphic object tree.

25. (Previously Presented) The apparatus according to claim 20, wherein the obscurance region representation is a quadtree.

26. (Currently Amended) An apparatus for creating an image, the image being formed by rendering a plurality of graphical objects to be composited according to an expression tree representing a compositing expression for the image, the expression tree including a plurality of nodes each representing an object of the image or an operation for combining sub-expressions of the compositing expression, said apparatus comprising:

opacity information determining means for determining an opacity region representation for ~~at least one~~ each node of the expression tree, the opacity region representation comprising one or more of three predetermined values, each predetermined value distinctly identifying whether a corresponding region of an object represented by the ~~at least one~~



node is an opaque region, a transparent region or a partially transparent region such that the opacity region representation simultaneously represents each opaque region, transparent region and partially transparent region of the object represented by the ~~at least one~~ node;

obscurance region representation determining means for determining an obscurance region representation for ~~the~~ at least one node of the expression tree based on an analysis of the opacity region representation associated with the at least one node ~~of the expression tree~~, such that, for said image, the at least one node simultaneously comprises both the opacity region representation and the obscurance region representation, with the obscurance region representation being separate from the opacity region representation of the at least one node and, the obscurance region representation being assigned one or more of a plurality of further predetermined values, each further predetermined value of the obscurance region representation distinctly identifying whether a corresponding region of at least one object is visible in the image;

first traversing means for traversing the expression tree to detect the node including the obscurance region representation;

partitioning means for partitioning the object into a plurality of regions upon detecting the node;

overlaying means for overlaying the obscurance region representation on the partitioned object such that the partitioned object is substantially encompassed within the obscurance region representation;

second traversing means for traversing the overlaid obscurance region representation to identify any of the plurality of regions of the partitioned object which included at least a portion of the visible region; and

image creating means for creating the image by rendering the identified regions.

27. (Previously Presented) The apparatus according to claim 26, wherein the obscurance region representation is traversed for each of the plurality of regions of the partitioned object.

28. (Previously Presented) The apparatus according to claim 26, further including map producing means for producing a map for the plurality of regions, wherein the map at least indicates any region which includes at least a portion of the visible region.

29. (Previously Presented) The apparatus according to claim 26, wherein the expression tree is a graphic object tree.

30. (Previously Presented) The apparatus according to claim 26, wherein the obscurance region representation is a quadtree.

31. (Currently Amended) A computer program for a computer comprising software code portions for performing a method of creating an image, the image being formed by rendering a plurality of graphical objects to be composited according to an expression tree representing a compositing expression for the image, the expression tree including a plurality of nodes each representing an object of the image or an operation for combining sub-expressions of the compositing expression, said program comprising:

code for determining an opacity region representation for ~~at least one~~ each node of the expression tree, the opacity region representation comprising one or more of three predetermined values, each predetermined value distinctly identifying whether a corresponding region of an object represented by the ~~at least one~~ node is an opaque region, a transparent region or a partially transparent region such that the opacity region representation simultaneously represents each opaque region, transparent region and partially transparent region of the object represented by the ~~at least one~~ node, wherein a union of each opacity region representation for the expression tree includes at least one of each of the three predetermined values;

code for determining an obscurance region representation for ~~the~~ at least one node based on an analysis of the opacity region representation associated with the at least one node ~~of the expression tree~~, such that, for said image, the at least one node simultaneously comprises both the opacity region representation and the obscurance region representation, with the obscurance region representation being separate from the opacity region representation of the at least one node ~~and, the obscurance region representation~~ being assigned one or more of a plurality of further predetermined values, each further predetermined value of said obscurance region representation distinctly identifying whether a corresponding region of the object represented by the at least one node is visible in the image;

code for partitioning the object into a plurality of regions;

code for overlaying the obscurance region representation on the partitioned object such that the partitioned object is substantially encompassed within the obscurance region representation;

code for traversing the overlaid obscurance region representation to identify any of the plurality of regions of the partitioned object which include at least a portion of the visible region; and

code for creating the image by rendering the identified regions.

32. (Currently Amended) A computer readable medium storing a computer program, wherein said computer program comprises software code portions for performing a method of creating an image, the image being formed by rendering a plurality of graphical objects to be composited according to an expression tree representing a compositing expression for the image, the expression tree including a plurality of nodes each representing an object of the image or an operation for combining sub-expressions of the compositing expression, said program comprising:

code for determining an opacity region representation for ~~at least one~~ each node of the expression tree, the opacity region representation being assigned one or more of three predetermined values, each predetermined value distinctly identifying whether a corresponding region of an object represented by the ~~at least one~~ node is an opaque region, a transparent region or a partially transparent region such that the opacity region representation simultaneously represents each opaque region, transparent region and partially transparent region of the object represented by the ~~at least one~~ node;

code for determining an obscurance region representation for ~~the at least one~~ node of the expression tree based on an analysis of the opacity region representation associated with the at least one node ~~of the expression tree~~, such that, for said image, the at least one node simultaneously comprises both the opacity region representation and the obscurance

region representation, with the obscurance region representation being separate from the opacity region representation of the at least one node and, the obscurance region representation being assigned one or more of a plurality of further predetermined values, each further predetermined value of the obscurance region representation distinctly identifying whether a corresponding region of at least one object is visible in the image;

code for traversing the expression tree to detect the node including the obscurance region representation;

code for partitioning the object into a plurality of regions upon detecting the node;

code for overlaying the obscurance region representation on the partitioned object such that the partitioned object is substantially encompassed within the obscurance region representation;

code for traversing the overlaid obscurance region representation to identify any of the plurality of regions of the partitioned object which include at least a portion of the visible region; and

code for creating the image by rendering the identified regions.

33. (Currently Amended) A method of processing an expression tree, the expression tree representing a compositing expression for compositing an image and comprising a plurality of nodes, each node of the expression tree representing an object of the image or an operation for combining sub-expressions of the compositing expression, said method comprising the steps of:

determining an opacity region representation for ~~at least one~~ each node of the expression tree, the opacity region representation comprising one or more of three predetermined values, each predetermined value distinctly identifying whether a corresponding region of an object represented by the ~~at least one~~ node is an opaque region, a transparent region or a partially transparent region such that the opacity region representation simultaneously represents each opaque region, transparent region and partially transparent region of the object represented by the ~~at least one~~ node; and

determining an obscurance region representation for ~~the~~ at least one node of the expression tree based on an analysis of the opacity region representation associated with at least one node ~~of the expression tree~~, such that, for said image, the at least one node simultaneously comprises both the opacity region representation and the obscurance region representation, with the obscurance region representation being separate from the opacity region representation of the at least one node ~~and, the obscurance region representation~~ being assigned one or more of a plurality of further predetermined values, each further predetermined value of the obscurance region representation distinctly identifying whether a corresponding region of at least one object is visible in the image; and

using the separate obscurance region representations determined for the expression tree to optimize the processing of the expression tree in compositing said image.

34. (Previously Presented) The method according to claim 33, wherein the opacity region representation is a first hierarchical structure.

35. (Previously Presented) The method according to claim 33, wherein the obscurance region representation is a second hierarchical structure.

36. (Previously Presented) The method according to claim 33, said method comprising the further step of identifying nodes representing complex graphical object.

37. (Previously Presented) The method according to claim 36, said method comprising the further step of determining an opacity region representation for each node identified.

Claims 38 and 39 (Cancelled).

40. (Previously Presented) The method according to claim 33, wherein an opacity region representation of a child node is at least propagated to a parent node associated with the child node.

Claim 41 (Cancelled).

42. (Previously Presented) The method according to claim 33, wherein an obscurance region representation of a parent node is at least propagated to a child node associated with the parent node.

43. (Previously Presented) The method according to claim 34, wherein the first hierarchical structure is dependent on an operation associated with a node for which the first hierarchical structure is constructed.

44. (Currently Amended) The method according to claim 35, wherein the second hierarchical structure for a node ~~are~~ is constructed by combining any first hierarchical structures associated with the node.

45. (Previously Presented) The method according to claim 34, wherein each leaf node of the first hierarchical structure is assigned one of the predetermined values depending on an opacity of a region associated with the leaf node.

46. (Previously Presented) The method according to claim 33, said method including the further step of converting the expression tree into a right leaning tree.

47. (Previously Presented) The method according to claim 34, wherein each node of the first hierarchical structure comprises a pointer indicating children nodes associated with the node.

48. (Previously Presented) The method according to claim 35, wherein the second hierarchical structure is a quadtree.



49. (Previously Presented) The method according to claim 33, wherein the opacity region representation is a bounding box.

50. (Previously Presented) The method according to claim 33, wherein the obscurance region representation is a bounding box.

51. (Currently Amended) A method of processing an expression tree, the expression tree representing a compositing expression for compositing an image and comprising a plurality of nodes, each node of the expression tree representing an object of the image or an operation for combining sub-expressions of the compositing expression, said method comprising the steps of:

determining an opacity quadtree for ~~at least one~~ each node of the expression tree, each leaf node of the opacity quadtree being assigned one of three predetermined values, each predetermined value distinctly identifying whether a corresponding sub-region is an opaque region, a transparent region or a partially transparent region;

determining an obscurance quadtree for ~~the~~ at least one node of the expression tree using the opacity quadtree associated with the at least one node ~~of the expression tree~~, such that, for said image, the at least one node simultaneously comprises both the opacity quadtree and the obscurance quadtree, with the obscurance quadtree being separate from the opacity quadtree of the at least one node ~~and~~, the obscurance quadtree being assigned one of a plurality of further predetermined values, each further predetermined value of the obscurance quadtree distinctly identifying whether a corresponding sub-region is visible in the image; and

using the separate obscurance quadtrees determined for the expression tree to optimize the processing of the expression tree in compositing said image.

52. (Currently Amended) A method of processing an expression tree, the expression tree representing a compositing expression for compositing an image and comprising a plurality of nodes, each node of the expression tree representing an object of the image or an operation for combining sub-expressions of the compositing expression, said method comprising the steps of:

identifying a node having an associated complex graphical object;

determining opacity information for the node;

determining an opacity region representation for ~~the~~ each node based on the opacity information associated with the node, the opacity region representation comprising one or more of three predetermined values, each predetermined value distinctly identifying whether a corresponding region of an object represented by the node is an opaque region, a transparent region or a partially transparent region such that the opacity region representation simultaneously represents each opaque region, transparent region and partially transparent region of the object represented by the node; and

determining an obscurance region representation for ~~the~~ at least one node using the opacity region representation[[,]] associated with the at least one node, such that, for said image, the at least one node simultaneously comprises both the opacity region representation and the obscurance region representation, with the obscurance region representation being separate from the opacity region representation of the node ~~and, the~~ obscurance region representation being assigned one or more of a plurality of further

predetermined values, each further predetermined value of the obscurance region representation distinctly identifying whether a corresponding region of the object is visible in the image; and

using the separate obscurance region representations determined for the expression tree to optimize the processing of the expression tree in compositing said image.

Claim 53 (Cancelled).

54. (Original) The method according to claim 52, wherein each node having an associated complex graphical object is tagged.

Claim 55 (Cancelled).

56. (Previously Presented) The method according to claim 52, wherein the opacity information is propagated down the expression tree.

57. (Previously Presented) The method according to claim 52, wherein an opacity region representation of a child node is at least propagated to a parent node associated with the child node.

Claim 58 (Cancelled).

59. (Previously Presented) The method according to claim 52, wherein an obscurance region representation of a parent node is at least propagated to a child node associated with the parent node.

60. (Previously Presented) The method according to claim 52, wherein the opacity region representation is dependent on an operation associated with a node for which the opacity region representation is determined.

61. (Previously Presented) The method according to claim 52, wherein the obscurance region representation for a node is determined by combining any opacity region representations associated with the node.

62. (Previously Presented) The method according to claim 52, wherein each leaf node of the opacity region representation is assigned a value depending on an opacity of a region associated with the leaf node.

63. (Previously Presented) The method according to claim 52, wherein each node of the opacity region representation comprises a pointer to indicate children nodes associated with the node.

64. (Previously Presented) The method according to claim 52, wherein the opacity and obscurance region representations are quadtrees.

65. (Currently Amended) An apparatus for processing an expression tree, the expression tree representing a compositing expression for compositing an image and comprising a plurality of nodes, each node of the expression tree representing an object of the image or an operation for combining sub-expressions of the compositing expression, said apparatus comprising:

means for determining an opacity region representation for ~~at least one~~ each node of the expression tree, the opacity region representation comprising one or more of three predetermined values, each predetermined value distinctly identifying whether a corresponding region of an object represented by the ~~at least one~~ node is an opaque region, a transparent region or a partially transparent region such that the opacity region representation simultaneously represents each opaque region, transparent region and partially transparent region of the object represented by the ~~at least one~~ node; and

means for determining an obscurance region representation for ~~the~~ at least one node of the expression tree based on an analysis of the opacity region representation associated with the at least one node ~~of the expression tree~~, such that, for said image, the at least one node simultaneously comprises both the opacity region representation and the obscurance region representation, with the obscurance region representation being separate from the opacity region representation of the at least one node ~~and, the obscurance region representation~~ being assigned one or more of a plurality of further predetermined values, each further predetermined value of the obscurance region representation distinctly identifying whether a corresponding region of at least one object is visible in the image; and

means for using the separate obscurance region representations determined for the expression tree to optimize the processing of the expression tree in compositing said image.

66. (Previously Presented) The apparatus according to claim 65, wherein the opacity region representation is a first hierarchical structure.

67. (Previously Presented) The apparatus according to claim 65, wherein the obscurance region representation is a second hierarchical structure.

68. (Previously Presented) The apparatus according to claim 65, further comprising means for identifying nodes having an associated complex graphical object.

69. (Previously Presented) The apparatus according to claim 68, further comprising means for determining an opacity region representation for each node identified.

70. (Previously Presented) The apparatus according to claim 67, wherein the second hierarchical structure is a quadtree.

71. (Previously Presented) The apparatus according to claim 65, wherein the opacity region representation is a bounding box.

72. (Previously Presented) The apparatus according to claim 65, wherein the obscurance region representation is a bounding box.

73. (Currently Amended) An apparatus for processing an expression tree, the expression tree representing a compositing expression for compositing an image and comprising a plurality of nodes, each node of the expression tree representing an object of the image or an operation for combining sub-expressions of the compositing expression, said apparatus comprising:

means for determining an opacity quadtree for ~~at least one~~ each node of the expression tree, each leaf node of the opacity quadtree being assigned one of three predetermined values, each predetermined value distinctly identifying whether a corresponding sub-region is an opaque region, a transparent region or a partially transparent region;

means for determining an obscurance quadtree for ~~the~~ at least one node of the expression tree using the opacity quadtree associated with the at least one node ~~of the expression tree~~, such that, for said image, the at least one node simultaneously comprises both the opacity quadtree and the obscurance quadtree, with the obscurance quadtree being separate from the opacity quadtree of the at least one node ~~and, the obscurance quadtree~~ being assigned one of a plurality of further predetermined values, each further predetermined value of the obscurance region representation distinctly identifying whether a corresponding sub-region is visible in the image; and

means for using the separate obscurance quadtrees determined for the expression tree to optimize the processing of the expression tree in compositing said image.

74. (Currently Amended) An apparatus for processing an expression tree, the expression tree representing a compositing expression for compositing an image and comprising a plurality of nodes, each node of the expression tree representing an object of the image or an operation for combining sub-expressions of the compositing expression, said apparatus comprising:

means for identifying a node having an associated complex graphical object;

means for determining opacity information for the node;

means for determining an opacity region representation for ~~the~~ each node based on the opacity information associated with the node, the opacity region representation comprising one or more of three predetermined values, each predetermined value distinctly identifying whether a corresponding region of an object represented by the node is an opaque region, a transparent region or a partially transparent region such that the opacity region representation simultaneously represents each opaque region, transparent region and partially transparent region of the object represented by the node;

means for determining an obscurance region representation for ~~the~~ at least one node using the opacity region representation[[,]] associated with the at least one node, such that, for said image, the at least one node simultaneously comprises both the opacity region representation and the obscurance region representation, with the obscurance region representation being separate from the opacity region representation of the node ~~and, the~~ obscurance region representation being assigned one or more of a plurality of further predetermined values, each further predetermined value of the obscurance region representation



distinctly identifying whether a corresponding region of at least one object is visible in the image;  
and

means for using the separate obscurance region representations  
determined for the expression tree to optimize the processing of the expression tree in  
compositing image.

Claim 75 (Cancelled).

76. (Original) The apparatus according to claim 74, wherein each node  
having an associated complex graphical object is tagged.

Claim 77 (Cancelled).

78. (Currently Amended) A computer program for a computer comprising  
software code portions for performing a method of processing an expression tree, the expression  
tree representing a compositing expression for compositing an image and comprising a plurality  
of nodes, each node of the expression tree representing an object of the image or an operation for  
combining sub-expressions of the compositing expression, said program comprising:

code for determining an opacity region representation for ~~at least one~~  
each node of the expression tree, the opacity region representation comprising one or more of  
three predetermined values, each predetermined value distinctly identifying whether a  
corresponding region of an object represented by the ~~at least one~~ node is an opaque region, a  
transparent region or a partially transparent region such that the opacity region representation

simultaneously represents each opaque region, transparent region and partially transparent region of the object represented by the ~~at least one~~ node;

code for determining an obscurance region representation for ~~the~~ at least one node of the expression tree based on an analysis of the opacity region representation associated with the at least one node ~~of the expression tree~~, such that, for said image, the at least one node simultaneously comprises both the opacity region representation and the obscurance region representation, with the obscurance region representation being separate from the opacity region representation of the at least one node ~~and, the obscurance region representation~~ being assigned one or more of a plurality of further predetermined values, each further predetermined value of the obscurance region representation distinctly identifying whether a corresponding region of the object is visible in the image; and

code for using the separate obscurance region representations determined for the expression tree to optimize the processing of the expression tree in compositing said image.

79. (Currently Amended) A computer readable medium storing a computer program, wherein said computer program comprises software code portions for performing a method of processing an expression tree, the expression tree representing a compositing expression for compositing an image and comprising a plurality of nodes, each node of the expression tree representing an object of the image or an operation for combining sub-expressions of the compositing expression, said program comprising:

code for determining an opacity quadtree for ~~at least one~~ each node of the expression tree, each leaf node of the opacity quadtree being assigned one of three

predetermined values, each predetermined value distinctly identifying whether a corresponding sub-region is an opaque region, a transparent region or a partially transparent region;

code for determining an obscurance quadtree for ~~the~~ at least one node of the expression tree using the opacity quadtree associated with the at least one node ~~of the expression tree~~, such that, for said image, the at least one node simultaneously comprises both the opacity quadtree and the obscurance quadtree, with the obscurance quadtree being separate from the opacity quadtree of the at least one node ~~and, the obscurance quadtree~~ being assigned one of a plurality of further predetermined values, each further predetermined value of the obscurance quadtree distinctly identifying whether a corresponding sub-region is visible in the image; and

code for using the separate obscurance quadtrees determined for the expression tree to optimize the processing of the expression tree in compositing the image.

80. (Currently Amended) A method of processing an expression tree, the expression tree representing a compositing expression for compositing an image and comprising a plurality of nodes, each node of the expression tree representing an object of the image or an operation for combining sub-expressions of the compositing expression, said method comprising the steps of:

determining an opacity quadtree for ~~the at least one~~ each node of the expression tree, each leaf node of the opacity quadtree being assigned one of three predetermined values, each predetermined value distinctly identifying whether a corresponding sub-region is an opaque region, a transparent region or a partially transparent region;

determining a compositing quadtree for ~~the~~ at least one node of the expression tree, such that, for said image, the at least one node of the compositing quadtree comprises both the opacity quadtree and the compositing quadtree, with the compositing quadtree for the at least one node being separate from the opacity quadtree of the at least one node and, the obscurance quadtree being determined using the opacity quadtree associated with the at least one node, wherein the compositing quadtree represents at least one visible region to be composited for an object associated with the at least one node; and

using the separate compositing quadtrees determined for the expression tree to optimize the processing of the expression tree in compositing said image.

Claim 81 (Cancelled).

82. (Currently Amended) The method according to claim ~~81~~ 80, further comprising the step of identifying nodes of the expression tree, for which a compositing quadtree is required, depending on the opacity quadtree associated with the node.

Claims 83-86 (Cancelled).

87. (Previously Presented) The method according to claim 80, wherein an opacity quadtree of a child node is at least propagated to a parent node associated with the child node.

88. (Previously Presented) The method according to claim 87, wherein an opacity quadtree of the parent node is determined by merging at least two further opacity quadtrees.

89. (Previously Presented) The method according to claim 87, wherein an opacity quadtree of the parent node is determined by merging at least one opacity quadtree and a bounding box.

Claim 90 (Cancelled).

91. (Previously Presented) The method according to claim 80, wherein a compositing quadtree of a parent node is at least propagated to a child node associated with the parent node.

Claim 92 (Cancelled).

93. (Previously Presented) The method according to claim 80, wherein each leaf node of the opacity quadtree is assigned one of the predetermined values depending on an opacity of a sub-region associated with the leaf node.

94. (Previously Presented) The method according to claim 80, wherein each node of the opacity quadtree comprises a pointer to indicate child nodes associated with the node.

Claim 95 (Cancelled).

96. (Currently Amended) A method of processing an expression tree, the expression tree representing a compositing expression for compositing an image and comprising a plurality of nodes, each node of the expression tree representing an object of the image or an operation for combining sub-expressions of the compositing expression, said method comprising the steps of:

determining an opacity quadtree for ~~at least one~~ each node of the expression tree, each leaf node of the opacity quadtree being assigned one of three predetermined values, each predetermined value distinctly identifying whether a corresponding sub-region is an opaque region, a transparent region or a partially transparent region; and

determining a compositing quadtree for ~~the~~ at least one node of the expression tree, such that, for said image, the at least one node of the compositing quadtree comprises both the opacity quadtree and the compositing quadtree, wherein the compositing quadtree is separate from the opacity quadtree of the at least one node and is determined using the opacity quadtree determined for the at least one node, and wherein the compositing quadtree represents at least visible regions, load regions and invisible regions to be composited, for an object associated with the at least one node; and

using the separate compositing quadtrees determined for the expression tree to optimize the processing of the expression tree in compositing said image.

97. (Currently Amended) A method of processing an expression tree, the expression tree representing a compositing expression for compositing an image and comprising

a plurality of nodes, each node of the expression tree representing an object of the image or an operation for combining sub-expressions of the compositing expression, said method comprising the steps of:

performing a first traversal of the expression tree to determine an opacity region representation for ~~at least one~~ each node of the expression tree, the opacity region representation comprising one or more of three predetermined values, each predetermined value distinctly identifying whether a corresponding region of an object represented by the at least one node is an opaque region, a transparent region or a transparent region such that the opacity region representation simultaneously represents each opaque region, transparent region and partially transparent region of the object represented by the at least one node;

identifying nodes of the expression tree, for which compositing information is required, depending on the opacity region representation associated with each node;

performing a second traversal of the expression tree to determine compositing region representations for each identified node of the expression tree, such that, for said image, each node of the compositing region representation comprises both the opacity region representation and the compositing region representation, wherein the compositing region representation for each node is separate from the opacity region representation for each node and is determined using the opacity region representation determined for each node, and wherein the compositing region representation indicates at least invisible regions, load regions and visible regions represented by each node; and

using the separate compositing region representations determined for the expression tree to optimize the processing of the expression tree in compositing said image.

98. (Previously Presented) The method according to claim 97, wherein the compositing information is represented by a first hierarchical structure.

99. (Previously Presented) The method according to claim 98, wherein the opacity region representation comprises a second hierarchical structure representing an opacity of a region associated with a node.

100. (Previously Presented) The method according to claim 98, wherein the opacity region representation is a bounding box representing an opacity of a region associated with a node.

101. (Previously Presented) The method according to claim 98, wherein the first hierarchical structure is dependent on the opacity region representation.

102. (Previously Presented) The method according to claim 97, wherein the first traversal is a bottom-up traversal.

103. (Previously Presented) The method according to claim 99, wherein opacity region representation of a child node is at least propagated to a parent node associated with the child node.



104. (Previously Presented) The method according to claim 103, wherein opacity region representation of the parent node is determined by merging at least two second hierarchical structures.

105. (Previously Presented) The method according to claim 103, wherein opacity region representation of the parent node is determined by merging at least one second hierarchical structure and a bounding box.

106. (Previously Presented) The method according to claim 97, wherein the second traversal is a top-down traversal.

107. (Previously Presented) The method according to claim 106, wherein a first hierarchical structure of a parent node is at least propagated to a child node associated with the parent node.

108. (Currently Amended) An apparatus for processing an expression tree, the expression tree representing a compositing expression for compositing an image and comprising a plurality of nodes, each node of the expression tree representing an object of the image or an operation for combining sub-expressions of the compositing expression, said apparatus comprising:

means for determining an opacity quadtree for ~~at least one~~ each node of the expression tree, each leaf node of the opacity quadtree being assigned one of three

predetermined values, each predetermined value distinctly identifying whether a corresponding sub-region is an opaque region, a transparent region or a partially transparent region;

means for determining a compositing quadtree for ~~the~~ at least one node ~~of the expression tree~~, such that, for said image, the at least one node simultaneously comprises both the opacity quadtree and the compositing quadtree, with the compositing quadtree for the at least one node being separate from the opacity quadtree of the at least one node ~~and, the~~ compositing quadtree being determined using the opacity quadtree determined for the at least one node, wherein the compositing quadtree represents at least one visible region to be composited for an object associated with the at least one node; and

using the separate compositing quadtrees determined for the expression tree to optimize the processing of the expression tree in compositing said image.

Claim 109 (Cancelled).

110. (Currently Amended) The apparatus according to claim 108, further comprising means for identifying nodes of the expression tree, for which a compositing quadtree is required, depending on ~~[[a]]~~ an opacity quadtree associated with the node.

Claims 111 and 112 (Cancelled).

113. (Currently Amended) An apparatus for processing an expression tree, the expression tree representing a compositing expression for compositing an image and comprising a plurality of nodes, each node of the expression tree representing an object of the

image or an operation for combining sub-expressions of the compositing expression, said apparatus comprising:

means for determining an opacity quadtree for ~~at least one~~ each node of the expression tree, each leaf node of the opacity quadtree being assigned one of three predetermined values, each predetermined value distinctly identifying whether a corresponding sub-region is an opaque region, a transparent region or a partially transparent region represented by the at least one node;

means for determining a compositing quadtree for ~~the~~ at least one node ~~of the expression tree~~ such that, for said image, the at least one node simultaneously comprises both the opacity quadtree and the compositing quadtree, wherein the compositing quadtree is separate from the opacity quadtree of the at least one node and is determined for the at least one node using the opacity quadtree determined for the at least one node, and wherein the compositing quadtree represents at least invisible regions, load regions and visible regions to be composited, for an object associated with the at least one node; and

using the separate compositing quadtrees determined for the expression tree to optimize the processing of the expression tree in compositing said image.

114. (Currently Amended) An apparatus for processing an expression tree, the expression tree representing a compositing expression for compositing an image and comprising a plurality of nodes, each node of the expression tree representing an object of the image or an operation for combining sub-expressions of the compositing expression, said apparatus comprising:

means for performing a first traversal of the expression tree to determine an opacity region representation for ~~at least one~~ each node of the expression tree, the opacity region representation comprising one or more of three predetermined values, each predetermined value distinctly identifying whether a corresponding region of an object represented by the at least one node is an opaque region, a transparent region or a partially transparent region such that the opacity region representation simultaneously represents each opaque region, transparent region and partially transparent region of the object represented by the at least one node;

means for identifying nodes of the expression tree, for which compositing information is required, depending on the opacity region representation associated with each node;

means for performing a second traversal of the expression tree to determine compositing region representations for each identified node ~~of the expression tree,~~ such that, for said image, the node simultaneously comprises both the opacity region representation and the composite region representation, wherein the compositing region representation for each node is separate from the opacity region representation for said node and is determined using the opacity region representation determined for each node, and wherein the compositing region representation indicates at least invisible regions, load regions and visible regions to be composited for an object associated with each node; and

using the separate compositing region representation determined for the expression tree to optimize the processing of the expression tree in compositing said image.

115. (Currently Amended) A computer program for a computer comprising software code portions for performing a method of processing an expression tree, the expression tree representing a compositing expression for compositing an image and comprising a plurality of nodes, each node of the expression tree representing an object of the image or an operation for combining sub-expressions of the compositing expression, said program comprising:

code for determining an opacity quadtree for ~~at least one~~ each node of the expression tree, each leaf node of the opacity quadtree being assigned one or more of three predetermined values, each predetermined value distinctly identifying whether a corresponding sub-region is an opaque region, a transparent region or a partially transparent region;

code for determining a compositing quadtree for ~~the~~ at least one node ~~of the expression tree~~, such that, for said image, the at least one node simultaneously comprises both the opacity quadtree and the compositing quadtree, the compositing quadtree for the at least one node being separate from the opacity region representation of the at least one node ~~and, the~~ compositing region representation being determined using the opacity quadtree determined for the at least one node, wherein the compositing quadtree represents at least one visible region to be composited for an object associated with the at least one node; and

code for using the separate compositing quadtrees determined for the expression tree to optimize the processing of the expression tree in compositing the image.

116. (Currently Amended) A computer readable medium storing a computer program, wherein said computer program comprises software code portions for performing a method of processing an expression tree, the expression tree representing a compositing expression for compositing an image and comprising a plurality of nodes, each node of the

expression tree representing an object of the image or an operation for combining sub-expressions of the compositing expression, said program comprising:

code for performing a first traversal of the expression tree to determine an opacity region representation for ~~at least one~~ each node of the expression tree, the opacity region representation comprising one or more of three predetermined values, each predetermined value distinctly identifying whether a corresponding region of an object represented by the at least one node is an opaque region, a transparent region or a partially transparent region represented such that the opacity region representation simultaneously represents each opaque region, transparent region and partially transparent region of the object represented by the at least one node;

code for identifying nodes of the expression tree for which compositing information is required, depending on the opacity region representation associated with each node;

code for performing a second traversal of the expression tree to determine compositing region representations for each identified node ~~of the expression tree~~, such that, for said image, the node simultaneously comprises both the opacity region representation and the composite region representation, wherein the compositing region representation for each node is separate from the opacity region representation for each node and is determined using the opacity region representation determined for each node, and wherein the compositing region representation indicates at least invisible regions, load regions and visible regions represented by each node; and

code for using the separate compositing region representations determined for the expression tree to optimize the processing of the expression tree in compositing said image.